

21st International Conference on Computing in High Energy and Nuclear Physics (CHEP2015)



Contribution ID: 321

Type: **oral presentation**

Fast event generation on graphics processing unit (GPU) and its integration into the MadGraph system.

Monday, 13 April 2015 16:30 (15 minutes)

Fast event generation system of physics processes is developed using graphics processing unit (GPU). The system is based on the Monte Carlo integration and event generation programs, BASES/SPRING, which were originally developed in FORTRAN.

They were rewritten on the CUDA platform provided by NVIDIA in order for the implementation of these programs to GPUs.

Since the Monte Carlo integration algorithm is composed of a lot of independent function calls at multi-dimensional space, highly parallel architecture of GPU is very suitable for the improvement of their performance.

The performance of event generations based on the integrated results can be also easily improved by the event parallelization on GPU.

Parallelized programs show very good performance in process time compared to the existing event generation programs.

For the computation of cross sections of physics processes on GPU the helicity amplitude calculation package in FORTRAN is implanted in the CUDA framework as "HEGET" library, and new phase space generation library and random number generator are developed in order for the better generation efficiency on GPU.

The event generation system on GPU is tested using general Standard Model processes and computed cross sections are consistent with those obtained with the MadGraph system which is widely used in the field of elementary particle physics.

The total process time of the new system on GPU is compared with the equivalent programs on CPU and its improvement factors for various physics processes range from 10 to 100 depending on the complexity of their final states.

In order to achieve better interface for the generation of various physics processes and also to realize wider application of the fast Monte Carlo integration program the system has been integrated into the MadGraph5. Also the HEGET library for the helicity amplitude computations is integrated into the ALOHA system of the MadGraph5.

Primary author: Dr KANZAKI, Junichi (KEK)

Presenter: Dr KANZAKI, Junichi (KEK)

Session Classification: Track 8 Session

Track Classification: Track8: Performance increase and optimization exploiting hardware features